INSTITUT PASTEUR

Research in Microbiology 159 (2008) 27–30

www.elsevier.com/locate/resmic

The development of microbiology and the Institut Pasteur: an historical bibliometric analysis

As with many areas of fundamental life sciences, concepts of Microbiology research have been studied since the inception of scientific investigation and were as much a part of ''Natural Philosophy'' when the first journals were launched in the 17th century. Since these first journals, the life sciences differentiated and fragmented into various fields over the next 150 years until, according to the Ulrich's Periodical Directory [6] the first Microbiology journals were launched in 1887, The Institute Pasteur's own journal, Annales de l'Institut Pasteur (now Research in Microbiology), and Zentralblatt für Bakteriologie (now the International Journal of Medical Microbiology). Since the launch of these first titles, the number of journals has grown at an annual growth rate of 15% to the current total of 189 journals [6]. Fig. 1 illustrates this growth in journals.

So what has driven this growth in journals? As with all areas of research the growth in the number of journals is proportional to the number of active researchers in the field and consequently the output of articles. Fig. 2 illustrates the growth in articles since 1981 within the ThomsonScientific's Journal Citation Reports category Microbiology, which includes 89 journals [1].

As we are currently celebrating 120 years of the Institut Pasteur, one logically thinks back to Louis Pasteur as one of the first to perform research into the fermentation process and identify its cause by the growth of micro-organisms, the discovery of pasteurisation and the principles of anaerobiosis. Some argue that if a scientist makes a historical discovery in a certain area then this acts as grounding for that area within the researcher's country of origin for years to come. If this holds true then France should continue to develop important research within Microbiology. Fig. 3 illustrates the impact – the average citations per article – within the major fields covered by ThomsonScientific National Science Indicators [4]. Indeed Microbiology is the fourth highest impact field within French research, behind areas such as Molecular Biology & Genetics and Immunology – areas akin to Microbiology and areas in which the Institute Pasteur is also active. Therefore Microbiology is an important area for French research output.

Each year, according to Scopus [5], researchers from the Institut Pasteur publish over 1200 articles in journals around the world. These articles generate thousands of citations and provide an important contribution to the body of work in Microbiology. In more recent times several top articles published by

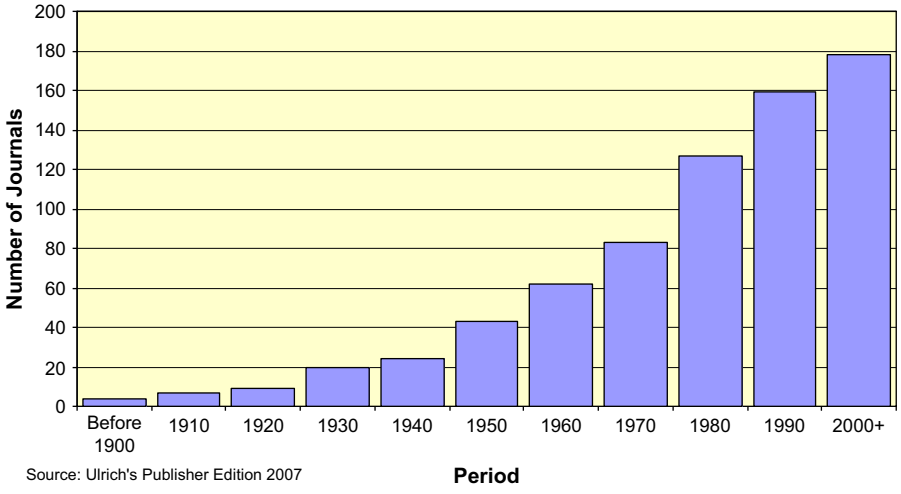

Fig. 1. Launch of microbiology journals.

doi:10.1016/j.resmic.2007.12.002

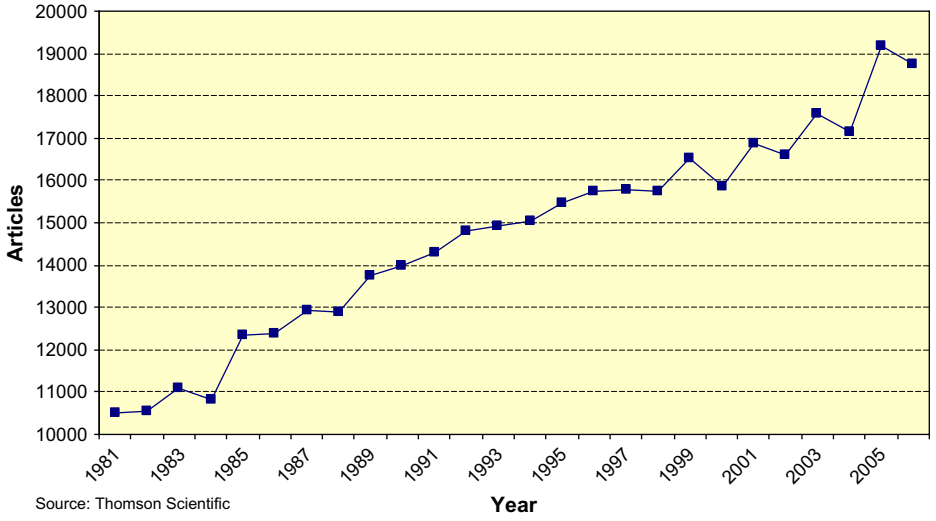

Fig. 2. Microbiology articles published from 1981 to 2006.

the Institute Pasteur have been well cited in the literature and are included in Table 1. As with many other research centres of excellence, the Institut Pasteur publishes journals of its own.

As previously mentioned, The Institute's first journal "Annales del' Institut Pasteur" was launched in 1887 by Emile Duclaux under the patronage of Louis Pasteur. The Editorial Committee included Chamberland, Grancher, Nocard, Roux and Straus, and the first issue began with Louis Pasteur's "Lettre sur la Rage" which clearly defines the spirit of the journal: "You have informed me, my dear Duclaux, that you intend to start a monthly collection of articles, entitled 'Annales de l'Institut Pasteur'. You will be rendering a service that will be appreciated by the ever increasing number of young scientists who are attracted to microbiological studies. In your "Annales", our laboratory research will of course occupy a central position, but the work from outside groups that you intend to publish will be a source of competitive stimulation for all of us."

That first volume included 53 articles as well as critical reviews and book reviews. From that time on, the Annales

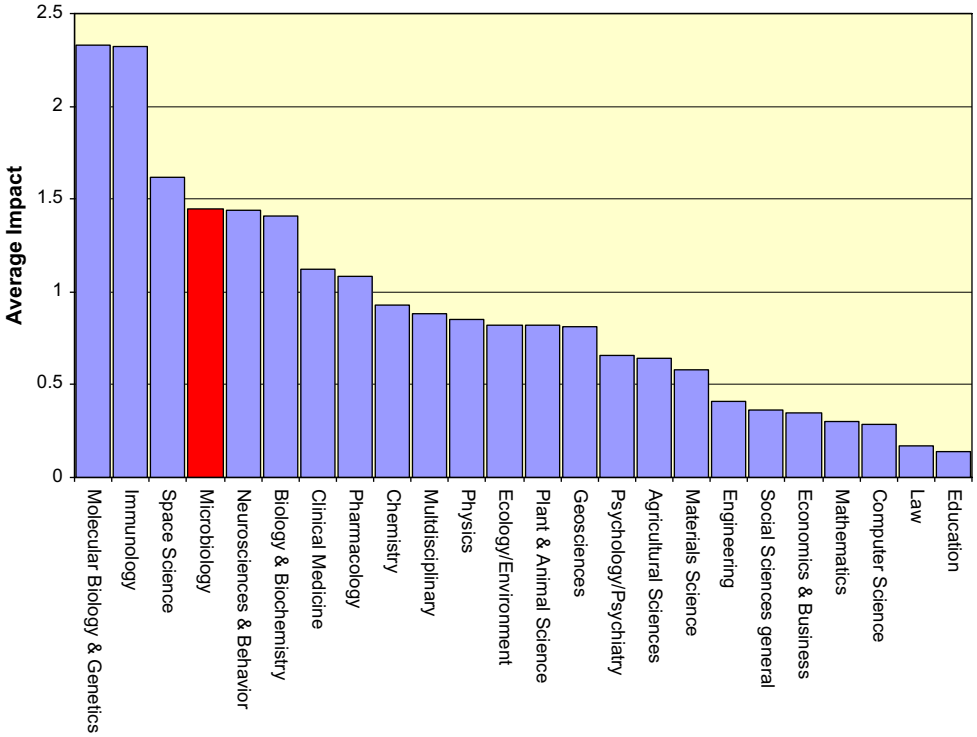

Fig. 3. Average impact of subjects within France.

Table 1
Top papers from Institute Pasteur 2002–2006

Authors	Title	Year	Journal	Citations
Girardin et al.	NOD2 is a general sensor of peptidoglycan through muramyl dipeptide (MDP) detection	2003	Journal of Biological Chemistry	465
Girardin et al.	NOD1 detects a unique muropeptide from gram-negative bacterial peptidoglycan	2003	Science	330
Brosch et al.	A new evolutionary scenario for the *Mycobacterium* tuberculosis complex	2002	Proceedings of the National Academy of Sciences of the United States of America	253
Bartosch et al	Infectious hepatitis C virus pseudo-particles containing functional E1–E2 envelope protein complexes	2003	Journal of Experimental Medicine	223
Garnier et al.	The complete genome sequence of *Mycobacterium bovis*	2003	Proceedings of the National Academy of Sciences of the United States of America	203
Viala et al.	NOD1 responds to peptidoglycan delivered by the *Helicobacter pylori* cag pathogenicity island	2004	Nature Immunology	184
Pym et al.	Recombinant BCG exporting ESAT-6 confers enhanced protection against tuberculosis	2003	Nature Medicine	165
Tallieux et al	DC-SIGN is the major *Mycobacterium tuberculosis* receptor on human dendritic cells	2003	Journal of Experimental Medicine	165

Source: Scopus.

appeared regularly every month, without interruption, even during the two world wars. Although the journal has undergone many changes over the past 100 years (in the title, the format, the language) reflecting the evolution in scientific publishing, it has consistently maintained the Pasteur tradition by publishing original reports on all aspects of microbiology.

The journal became Research in Microbiology in 1989 and has been a leading source of up-to-date information in the field of microbiology for more than a century. Currently edited by David Prangishvili, the journal publishes 10 issues a year, including an annual forum issue, containing original articles, reviews, and letters to the editor.

In 1999 the Institute launched its second journal, Microbes & Infection, edited by Stefan H.E. Kaufmann, which publishes research across all fields of infection and immunity, covering the different levels of host–microbe interactions. Recently Microbes & Infection was identified as having the highest percent increase in total citations among journals in the field of Immunology, according to a recent analysis of ISI's Essential Science Indicators [2]. Both journals are included in ThomsonScientific's Journal Citation Reports, Science Edition. A recent trend of the impact factors are shown in Fig. 4.

Both journals show healthy impact factors within their fields and have strong citation relationships to top journals. To illustrate this point we used a mapping logarithm developed by Leydesdorff [3] to produce a citation network of journals that are related to both journals. Fig. 5 illustrates this citation network.

The strength of the citation relationships between journals is measured by the density of lines that connect the journals together within the network, with the actual distance between the journals not being significant in this analysis. The size of the area which signifies the journal represents its impact factor.

Research in Microbiology has its strongest links to Journal of Clinical Microbiology, Molecular Microbiology and FEMS Microbiology Letters and also includes several influential journals outside of the field including Journal of Biological Chemistry and Proceedings of the National Academy of Sciences of the United States of America. Microbes & Infection has its strongest links to Immunology Reviews, Infection & Immunity and Journal of Leukocyte Biology. As this discussion has shown the Institute Pasteur is a centre of excellence which publishes a substantial amount of research in several fields each year, with its focus on Microbiology. The standard of the research it publishes is amongst the best in the field and attracts a high degree of citation activity. The Institute's journals continue to grow and be well cited and have strong citation links to several key journals, not only within Microbiology, but across many areas of life science research.

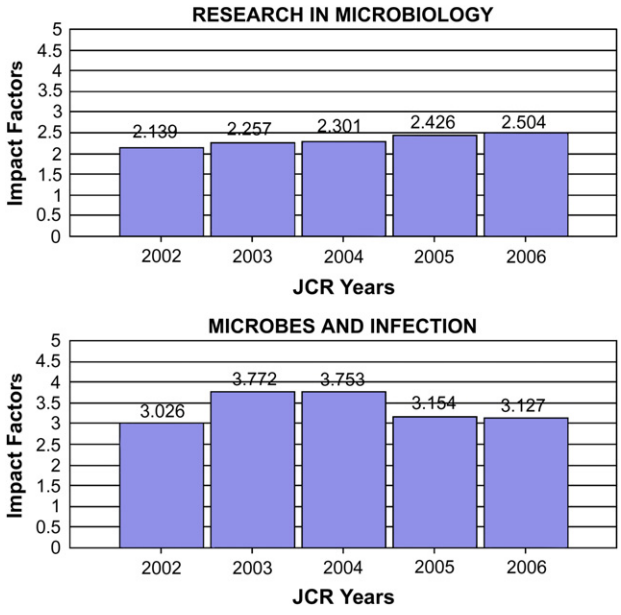

Fig. 4. Impact factor trends of research in microbiology and microbes and infection.

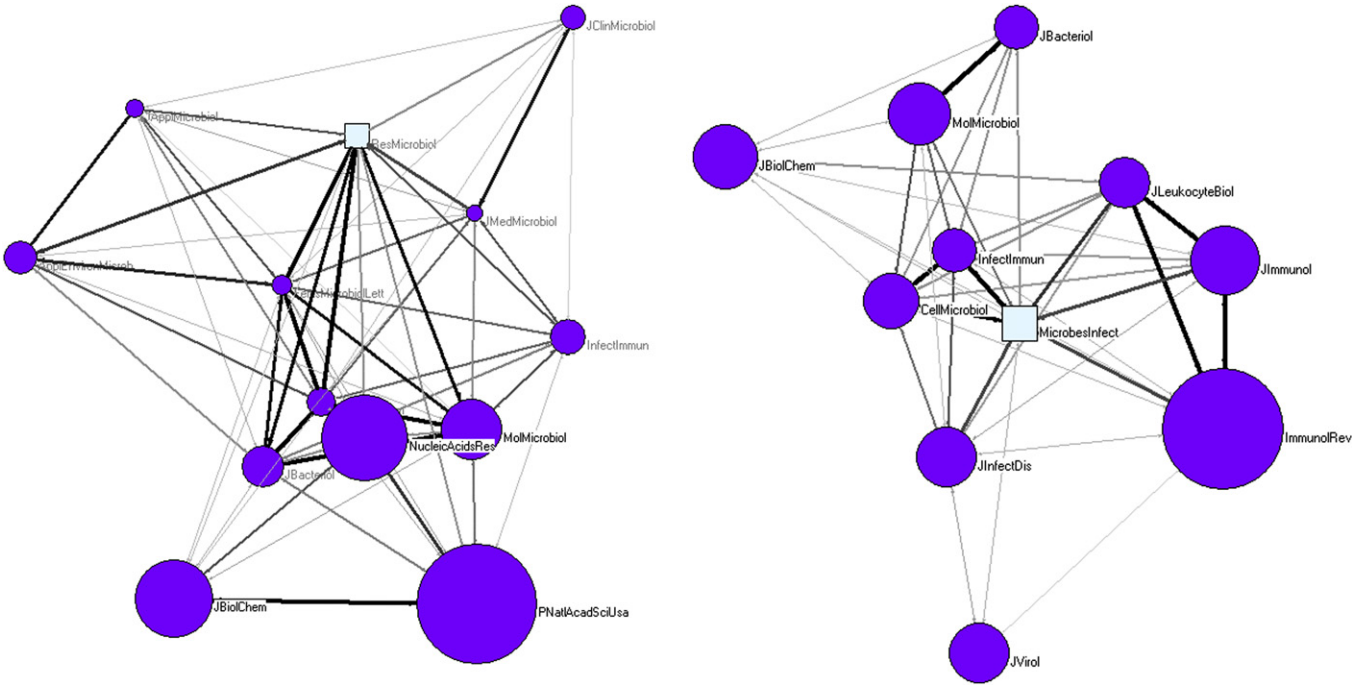

Fig. 5. Citation networks for research in microbiology and microbes and infection.

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14 November 2007

Available online 15 December 2007